ANNALS

OF THE

Association of American Geographers

VOLUME XX, 1930

DERWENT WHITTLESEY, *Editor*

PUBLISHED BY THE ASSOCIATION
March, June, September and December

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Annals of the Association of American Geographers

Subscription price: $3.00 per volume

Communications should be addressed to the editor,

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ANNALS of the

Association of American Geographers

VOLUME XX MARCH, 1930 No. 1

THE SIX-SIX WORLD MAP
Giving larger, better continents

MARK JEFFERSON

THE NEED

The world-maps that the cartographers of the past have made for us, on which to represent world-distributions, gave us continents distorted in shape or size and so small that a map on the page of a book could rarely show any detail clearly.

Most of the distributions that geographers wish to show are continental. All the world maps are mostly oceanic since the oceans cover much of the earth, but so much water is a pure loss to the student of terrestrial relations. Is it not possible to use what we want of the earth's surface without having the parts we do not want so much in the way? May we not have the desired portions on a much larger scale if we omit the vast wastes of sea?

The Six-Six world map (Fig. 1) offers well-shaped, equal area projections of the continents, rather more than a quarter larger than can be made on the same sheet of paper on the familiar, distorted projections for the entire world.

THE THEORY OF THE MAP

For accuracy the globe is the ideal base on which to place our data. Consider how we consult a globe. Suppose the eye is placed at reading distance from the globe above 45 degrees north latitude. If we bring the 90th-meridian-west to the front we shall have North America before us. Spin the globe till the 20th-meridian-east comes to the front and we look on Europe. On bringing the 90th-meridian-east to the front Asia lies before

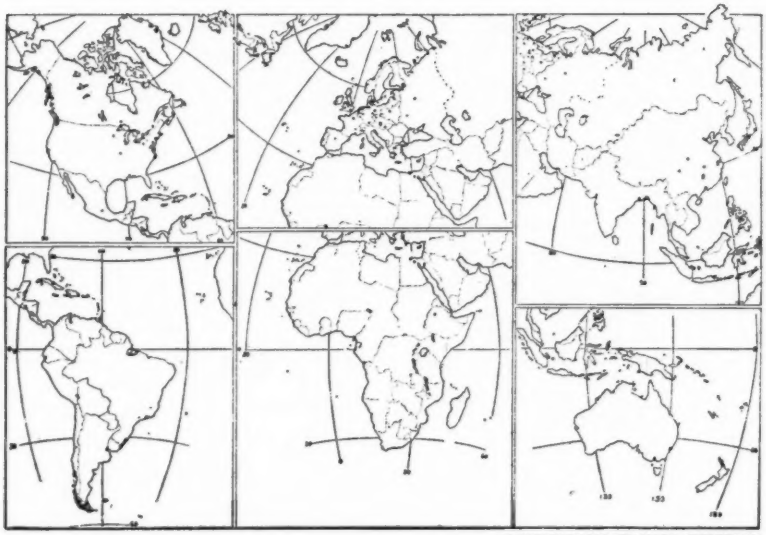

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FIG. 1.—The Primary Six-Six map. It is the world in six sixths, on equal area projections, better in shape than on any other world map, since a sixth of the world may be more accurately projected than a hemisphere, while all projections of the whole world at once are necessarily quite out of drawing.

From "Forty Exercises in Human Geography" (In Press)

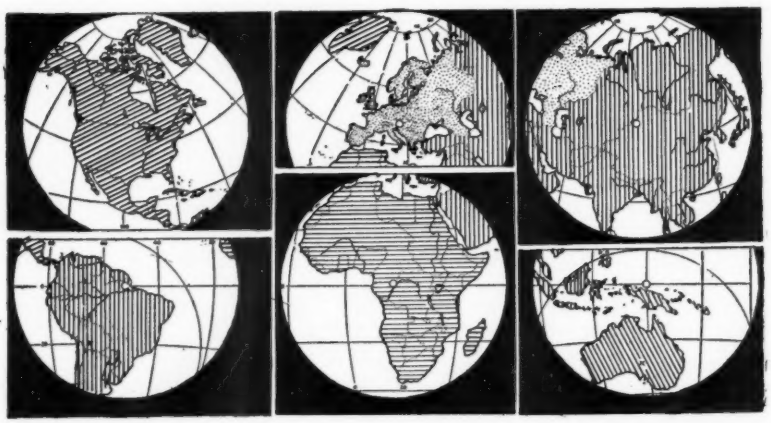

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FIG. 2.—Glimpse of six world regions each comprising a sixth of the earth's surface, about as we see them on turning the globe with the eye over 45° N. Lat. and then over the Equator. Each region covers the same area.

us. If we now tip up the globe till the equator comes under the eye we view South America, Africa, and the Australian world-regions successively as we bring the 60th-meridian-west, the 20th-east and the 135th-east one after another to our side.

Figure 2 sets before us in conjunct these six views of the regions of the earth. Usually it has been assumed that we see half of the globe at once. I suggest that we do not try to get more than a sixth of it in view at one time. That is as much as we can really grasp in one view and for that very reason it is as much as can be projected on a plane without great distortion.

Roughly speaking, a sixth of the earth's surface may be outlined on a cheap six-inch globe by drawing a circle on it with a radius of two and a half inches; this encloses 32,000,000 square miles. Asia, the largest continent, is fairly contained within such a circle. So, of course, are the five others. The thought comes at once to mind, here is the solution of the difficult problem of representing big and little continents on the same scale. We should not deal with continents at all as our units, but rather with world-regions. World-sixths would serve our purpose very well, especially if we do *not take these sixths without overlap.* The sixths selected overlap on each other a good deal, and consequently leave a little of the Indian ocean and a great part of the Pacific uncovered, like most of the Polar regions.

The continents are not satisfactory units for geography and never were. Darwin pointed out nearly a century ago that the real parting of the floras and faunas of North and South America was at the Rio Grande rather Panama. The same thing is true of the human inhabitants. We are English Americans north of the Rio Grande and Latin Americans to the south. Eurasia has never been anything but a single continent. Try to turn Russian data for the Empire or for the Soviets into parts for Europe and parts for Asia and you will discover that the Russians, who might be well qualified to know where Europe and Asia meet, disclaim any knowledge of the sort. There is no Russia-in-Europe and Russia-in-Asia at all for them. There is simply one Russia. The very excellent world region with which the ancients dealt for the first millennium or two of geography, the Mediterranean region, includes parts of three of our "continents." But nothing is gained by considering that very real region under three headings. It is not threefold but unitary.

Each of the circles of Figure 2 contains a traditional continent,

with generous overlaps of neighbor regions. Of course each sixth can be projected on flat paper very accurately. We shall further enlarge the areas covered by expanding the circles into rectangles. Then most of Eurasia comes into the Asiatic sheet, "Europe" includes New York and Boston, and "North America" takes in Paris and London. The map of South America includes the Cape Verde Islands and West African coast, the nearest point to America across the Atlantic.

THE NAME OF THE MAP

Instead of a world in (two) hemispheres we have here a world in six sixths. *Sixths,* however, is a fairly unpronounceable word so the name suggested is the Six-Six World. Each sixth is necessarily on the same scale as any other, areas are everywhere equivalent and the projection identical. In fact but two networks of coördinates have been used, one for Asia and one for Africa. On these all the continents have been drawn from large scale, two-degree-mesh maps. They suffice to represent most of our world phenomena such as precipitation, distributions of plants, animals, minerals, most climatic and geological data and all sorts of human activities except navigation and hydrographic investigation.

Arctic and Antarctic sixths may be added if desired, or by selecting the proper point as center a circle may be drawn for Europe to include the North Polar regions and one for Australia to include the Antarctic. This is an advantageous result of the largeness of the sixth as compared with most of the continents. The center from which the sixth is taken may be shifted freely. The North American sixth may be taken so as to include Hawaii. The Australian one may include at will Japan or most of India.

Such shifts, however, take away the advantage of our Six-Six map of presenting equivalent latitudes opposite each other, at least on the central meridian of each sixth. Thus we glance from America to Europe and Asia with the same impression of latitude expressed by height on the sheet as we have on the world-in-hemispheres, but a little more precisely.

Finally each sixth may be reproduced on a larger scale as a full page map. There is no necessity for redrawing to reproduce on world maps what we have worked out for a single continent, as at present there is, for now practically no continent map can be placed on a world map without the most trying sort of redrawing.

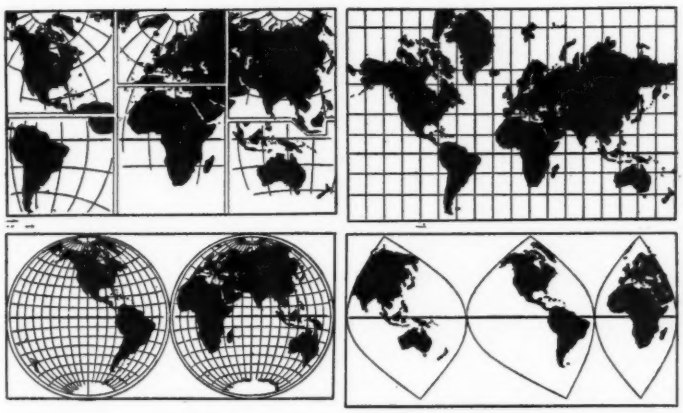


FIG. 3.—The six-six map beside mercator, world-in-hemispheres, and homolographic world maps, each measuring the same distance from side to side, showing the six-six map with continents about a fourh wider than on other maps because of the omission of the oceans. It has literally bigger and better continents!

Figure 3 shows the six-six map beside three of the commoner world maps, each on the same width as the others, to bring out the better shape and larger size of the six-six continents.

THE SECONDARY SIX-SIX MAP

However the overlap on neighboring regions is unnecessarily generous. Almost a quarter of the width of the North and South American sections may be omitted on the east side and a fifth of the South American one on the north. Similar strips may be trimmed off on two sides of "Africa" and three of "Europe." "Asia" can spare a strip on the west and "Australia" strips on west, north, and east. This has no effect on the scale on which they are left but only on the amount of paper they cover with adjacent regions apart from the continent. The result is the Secondary Six-Six map. It still shows the whole surface of all six continents with some overlap, but the reduction in paper covered makes it possible to get continents a third larger on this base than on other world maps on the same sized sheet of paper.

The writer works on a primary six-six base of scale 1:60,000,000, which has full width world-sixths (as shown in Figure 1), and was constructed with two-degree coördinates on the lands, in order to

facilitate the locating of data. Data so located on the primary base map are traced off on the secondary base for clear representation.[1]

On the secondary base was drawn Figure 4, a density-of-population map, here reproduced on the scale for which it was designed, to show the application of the new device. As the legend shows, it was designed for tinting, since black shadings on this scale would so obscure country boundaries as to make locations difficult to read. By the use of red and yellow, applied very lightly, a fairly transparent distinction may be spread on the regions with different population densities. To further enhance the clarity and distinctness of the map no parting is drawn on this world map between dense and moderate population densities. That is reserved for the larger, full-page maps, which may have easily twice as large a scale as this.

USES CLAIMED FOR THE MAP

This is not a new map projection, but a grouping, which is entirely new, of six equal-area projections of sixths of the earth's surface, expanding the idea contained in the world-in-hemispheres to a result of greater accuracy with economy of space, which in turn enables us to increase the scale on the same sized paper. Places are shown in their proper latitude rather better than on the hemispheres.

For many oceanographic distributions, for some climatic ones, for the placing of coral islands or volcanoes, the author would not use the six-six map, but for most climatic and terrestrial data, especially those that most touch human life, it increases our power of showing the facts legibly to a notable degree.

[1]These two maps are not reproduced for this article, because of the cost. A comparison of Figures 1 and 4 will disclose the different segments used for each continent in the primary (Fig. 1) and the secondary (Fig. 4) bases.—Ed.

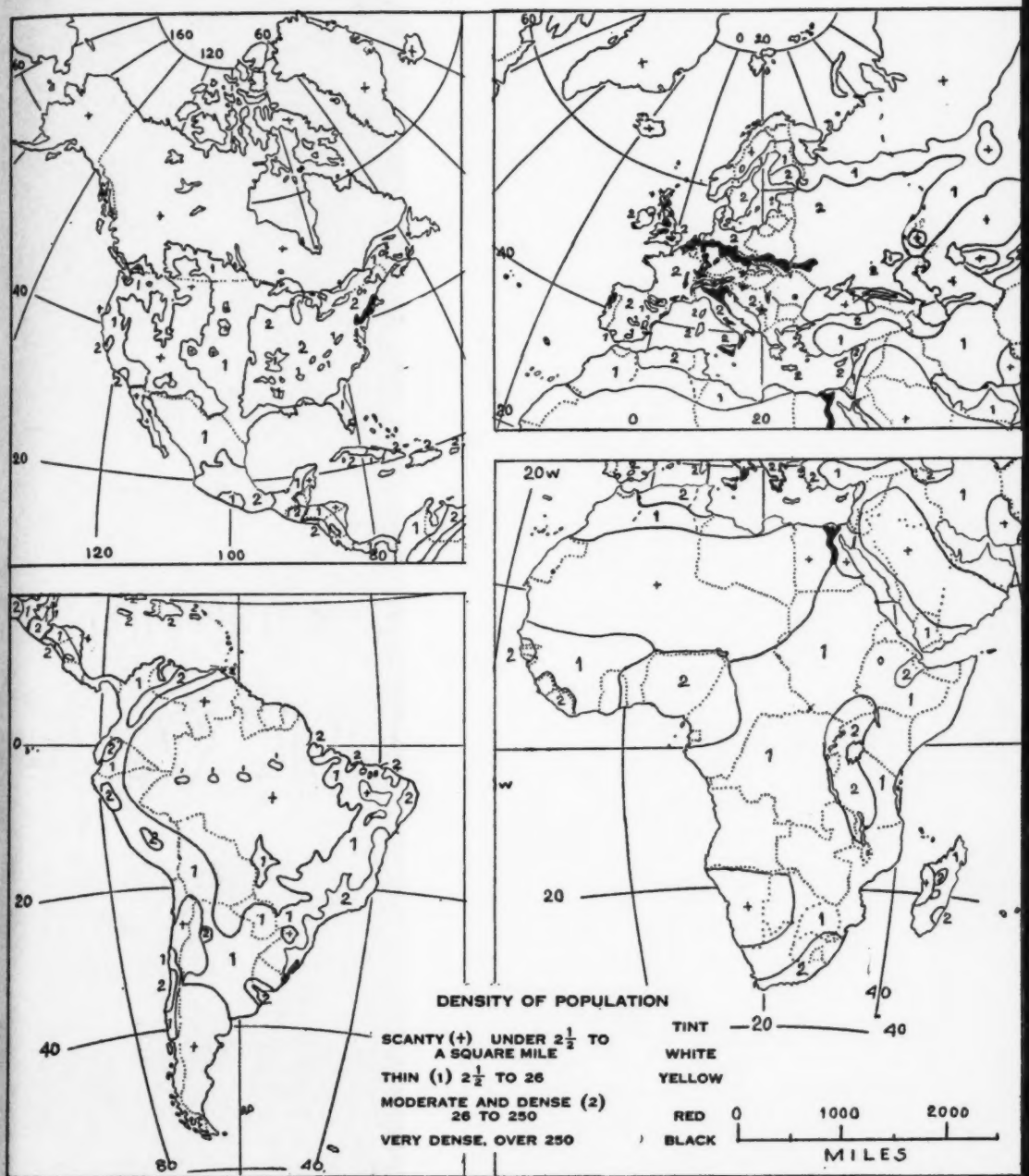
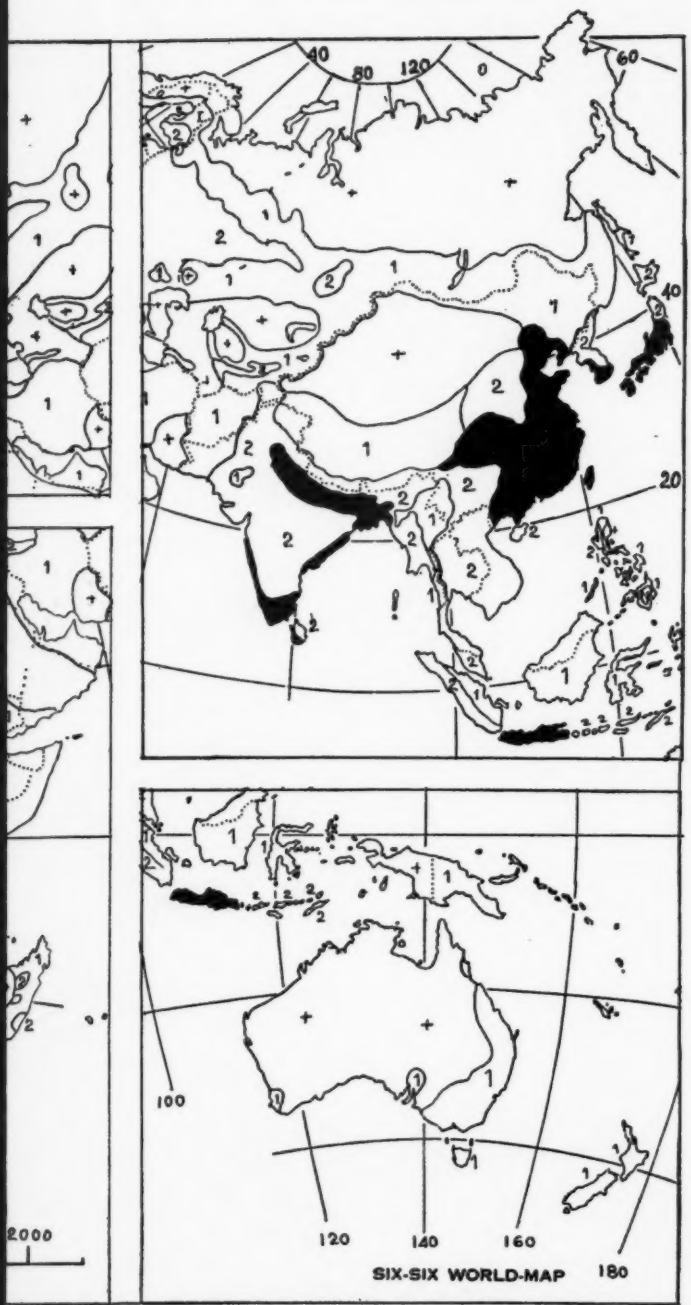


FIG. 4. Distribution of population densities in the world on the Secondary Six-Six map. Very dense population and moderate populations marked "2," to be tinted *red*. These are population densities above 25 and under 250 to the scale. Thin populations marked "1," to be tinted *yellow;* 2½ to 25 to the mile. Scanty population marked +, to be



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population is shown *black*, over 250 people to the square mile. Dense
ler 250 to the square mile, not separated on account of the smallness of
d +, to be left white.

THE USE OF LAND FOR RECREATION

K. C. McMURRY

A NEGLECTED ASPECT OF LAND UTILIZATION STUDIES

In the numerous studies in land utilization which have appeared in recent years the use of land for recreational purposes has not been included among the major classes. It has been held generally that farm, forest, and grazing lands, actual and potential, involve the great bulk of the usable area of the country, and that other types of use occupy such small area as to be negligible when speaking in general terms. A brief analysis of the present situation, at least in some sections, seems to indicate that the importance of recreation has not been appreciated generally, and that it is now the major form of use of land over considerable areas, and that the trend is toward rapid expansion.

TYPES OF RECREATIONAL USE OF LAND

Michigan has long been an important state in the recreational industry. The geographic basis of the more obvious forms is simple. The shores of the Great Lakes, the thousands of inland lakes, large and small, the extensive tracts of virtually unoccupied country, the relatively cool summer weather, lie behind the orthodox resort developments. The automobile and good roads have led to almost unbelievable magnification of this type of development. Almost every foot of the shores of the Great Lakes, and of every inland lake of reasonable attractiveness, has actual or potential resort value. It is now almost impossible to find attractive water frontage on lake or stream in the Lower Peninsula which has not already been preëmpted. It has been said that recreation now is the third industry in the state, surpassed in money value only by automobile manufacture and agriculture. While the economics of the subject remain somewhat hazy, there is enough truth in such a statement to warrant consideration. Certainly there are many communities in the northern part of the state which owe existence chiefly to this industry.

It is true that the total area involved in recreational properties of this type, mostly based upon water frontage, is comparatively small. On the other hand values are very high, especially as compared to adjoining lands without water frontage. This fact is

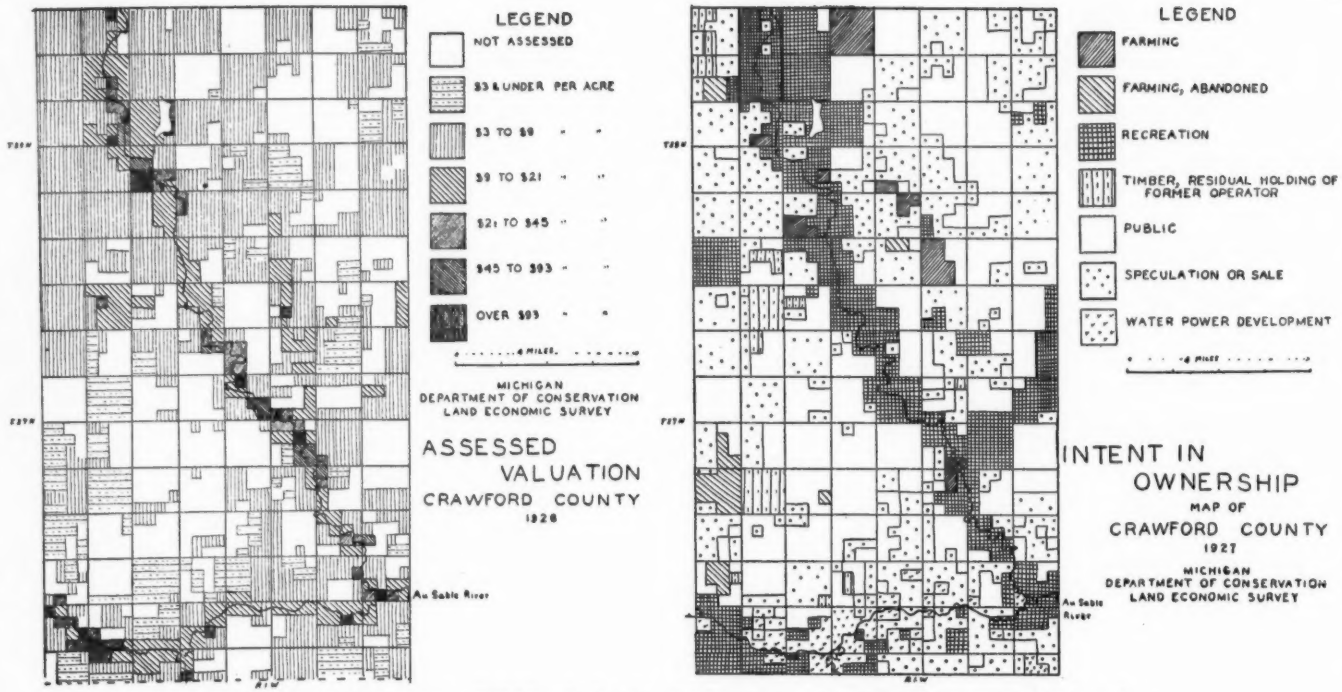

FIG. 1—Crawford County (Michigan) showing the importance of streams in a recreational region.

well illustrated in Roscommon County (Fig. 3), where three lakes, Houghton, Higgins, and St. Helens, are attractive to many forms of recreation. In this county the Land Economic Survey found that although the narrow strips of recreational developments occupied less than 3% of the area of the county, they accounted for more than 50% of the assessed valuation and tax income. In northeastern Crawford County (Fig. 3) the Au Sable River and its branches long has been famous as trout water. The concentration of land values along this stream, as contrasted to those of adjoining lands is well illustrated in the maps of Figure 1. This situation may be duplicated along various other streams, just as the Roscommon situation may be paralleled in many other counties. In the southern part of the state, in the highly developed agricultural sections, hundreds of small lakes with their resort developments add considerably to land values. Many farms with lake frontage have been bought at high prices, and though of much less relative importance than in the north, the business assumes considerable magnitude. In spite of seemingly inexhaustible resources, with thousands of inland lakes and hundreds of miles of Great Lakes frontage, the demand is so great and increasing so rapidly, that a distinct limitation of really high quality locations already is evident.

Although the resort type of recreational use of land is easily the most obvious, other forms of recreational use demand immensely greater area. It is estimated that during the last fall hunting season 6,000,000 hunters took to the field in the United States.[1] In Michigan approximately 400,000 small-game hunting licenses were issued in 1929. At least three-fourths of this number were for use in the southern agricultural half of the Lower Peninsula. This area of some 10,000,000 acres must provide the hunting grounds and game for this army of 300,000 men. An average of between 30 and 40 acres per hunter, in an area in which sixty per cent or more of the land is improved, indicates a certain degree of intensiveness of land use through a period of three or four months. And the demand for hunting facilities grows with extreme rapidity in this section, while the supply of land available to the public tends to shrink.

In the fall of 1929 seventy thousand deer hunting licenses were sold in Michigan. This is a high record, and more than twice the number of ten years ago. It is estimated that the wild land avail-

[1]American Game Protective Association: Release of Dec. 16, 1929.

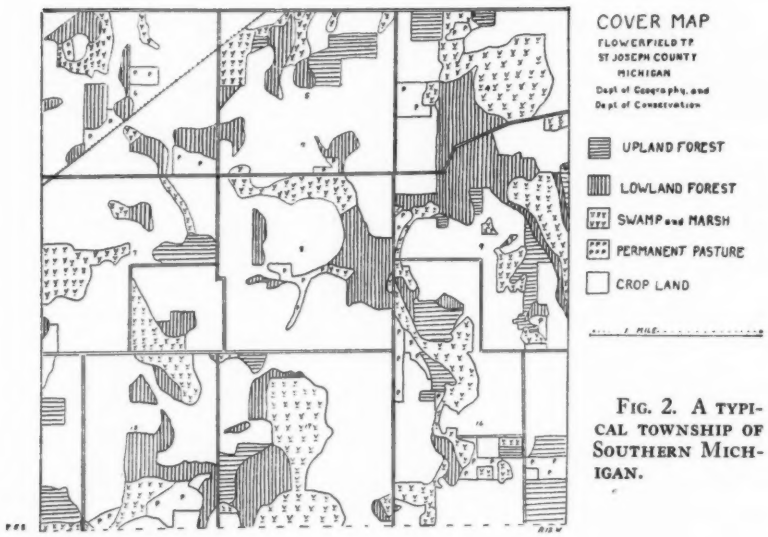

FIG. 2. A TYPICAL TOWNSHIP OF SOUTHERN MICHIGAN.

able in the state for deer hunting is some 16,000,000 acres. This gives about 200 acres per hunter for the average, but the hunters are concentrated in large part in the better sections. The deer hunting season lasts only two weeks, but lands are held in considerable volume almost exclusively for deer hunting. Several million dollars are spent each year by the host of hunters who journey to the north. The kill of some 20,000 deer is valued very highly, and the demand increases at an astonishing rate. The wild lands are coming more and more to assume value on the basis of their hunting qualities, rather than as potential agricultural or forest lands.

The southern third of Michigan ranks among the high-grade agricultural sections of the country in percentage of total area improved. It is an intensively farmed country, and has reached its peak in improved farm land. As indicated above, it also is an intensively hunted section. Among the game birds the pheasant, propagated and released by thousands by the state, has become most important. The cotton-tail rabbit is hunted intensively through a long season, while muskrats, skunks, and other fur bearers are taken in considerable numbers. There are a few partridges; waterfowls are hunted in the marshes, and the quail, while fairly numerous, is protected.

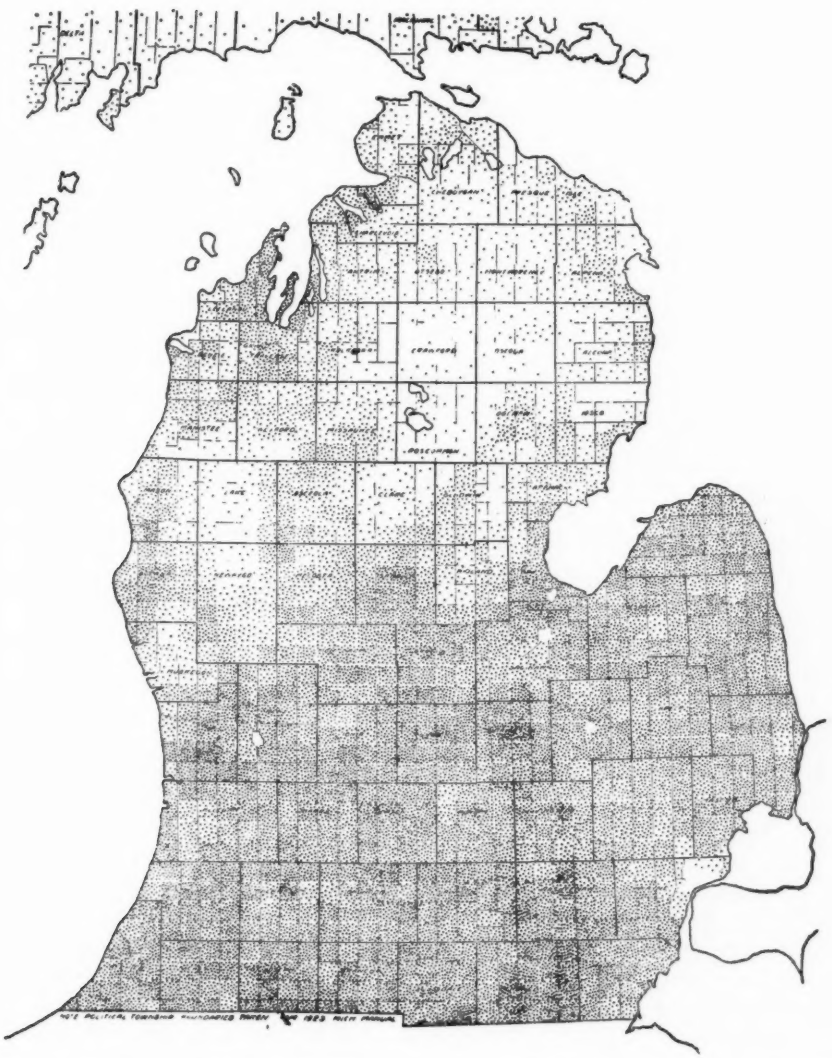

FIG. 3—IMPROVED LAND IN THE LOWER PENINSULA OF MICHIGAN. Each dot represents 500 acres of improved land. Where dots are scattering the district is mostly wild and the lands chiefly of value for forests and recreation.—Compiled from Supervisor's census, 1923, in coöperation with State Department of Agriculture by the Michigan Department of Conservation.

The problem of providing grounds well stocked with game in this section for the enormous body of hunters is a serious one. Many conflicting factors enter the situation. The land is all held privately, mostly by farmers. The trespass laws are severe. The hunting privilege becomes valuable in well stocked secctions. Little is known as to the amount and character of game cover, or the relations of game to natural cover types and to the farm crops. A recent survey of five townships, scattered through typical parts of this section of the state, shows that even in this intensively farmed country there is much natural cover, and that probably the carrying capacity for game is very high (Figure 2). In the past hunting has been carried on largely in technical trespass, but the situation is changing. Many areas have been bought up by wealthy sportsmen and developed into private game preserves for the exclusive use of the owners. Individuals and clubs have leased considerable acreage for hunting purposes, and numerous farmers derive appreciable income from this source. It seems probable that with the increasing demand for hunting facilities, the hunting rights will become more and more a valuable part of the farm economy, and that maintaining good stocking of game may become an important part of the farm system. The interest of hundreds of thousands of sportsmen in this type of farm product insures an insatiable market, for it seems impossible that the supply should ever meet the demand. Already many acres in this section of the state are devoted exclusively to this type of recreational use, and while no great amount of land can be assigned primarily to game, it seems probable that it may become an important and profitable by-product of the farms.

AN ALTERED ATTITUDE TOWARD WILD LANDS

Northern Michigan, together with similar sections of Wisconsin and Minnesota, commonly has been considered as potentially farm, grazing, or forest land. Agriculture has developed to some extent in many parts of this large area (Fig. 3). It has been assumed that, with increasing population and demand for farm land, many millions of acres would be cleared and cultivated and agriculture would become the dominant form of land use. Large owners, many of them former lumbermen, have held their lands and paid taxes in the thought that farm expansion would raise values. Realtors, agricultural agents, state officials, have combined in

booming these northern lands in the effort to attract settlers.[2] The results in general have not tended to prove the soundness of the original premise. Farm area has expanded in some sections during the past decade. In others it has shrunk considerably. On the whole there has been no appreciable gain for twenty years; the period of agricultural booming has passed, and the potential values of land for farm purposes have largely disappeared.

The geographic basis for the change in attitude is quite clear. Much of this northern country has low grade soils. Sands are dominant over large areas. In the Superior Upland soils are commonly thin and stony. There are great swamps of raw peat soil. The better quality soils occur commonly in small patches, isolated from one another, and in many cases with problems either of drainage or rough surface. The growing season is short, and the crops which are adaptable are few. Markets are distant, and transportation facilities inadequate in many sections. Due to the spotted distribution of settlements, with great stretches of wild land between, this problem is difficult to solve. A long period of experiment has shown definitely that even under the best conditions agricultural settlements have great difficulty in maintaining themselves. Under poorer conditions of environment, where settlement has made progress after enormous effort in clearing and improving land, farms are being abandoned, and the total improved area is shrinking. A complete change in the economic relations of agriculture must come about before any considerable expansion of farm lands may be expected in this region.

Some years ago much was made of the possibilities of large scale grazing in the cut-over, burned-over open areas of the north. Many large ranches were established, and sheep in particular were introduced in large numbers. In almost every case these ranches have been failures. The pasturage is available through but a short season, the winters are long and the snowfall very heavy. In many cases not enough good-grade cleared land has been available to grow the crops necessary for winter feeding. With control of fires the brush and tree growth tends to lower grazing values. There has been much complaint of the depredations of coyotes and wolves in some sections. Altogether it is clear that expansion of use of land on any large scale within the next few

[2]Lovejoy, P. S.: "Theory and Practice of Land Utilization," Journal of Land and Public Utility Economics, Vol. 1, No. 2, April, 1925.

decades for farm and ranchng purposes does not fit into the picture of geographic fact or experience.

Such land as is not assigned to farms and grazing in this region normally is classified as potential forest area. It is true that a considerable acreage of merchantable hardwood timber remains in the region. But in spite of the many years which have elapsed since the cutting of pine and hardwoods in most sections, there has been almost no reproduction of these native types of forest. Fire has so changed conditions that the present second growth consists of inferior species, in terms of the foresters' idea of a growing forest. It is true that Michigan has been a leader in reforestation. More acreage is planted to pine each year than in any other state. But in terms of the total area, artificial reforestation is almost negligible. Aside from planting by the state and in the National Forests, natural reproduction and growth must be depended upon. In few cases have private owners attempted to hold land exclusively for forest growth. There are many factors in this situation. The growing season is short. Even under the better conditions of soil, annual growth is slow, and in the great bulk of the area the soils are so poor as to reduce it still further. There are few cases where planted white pine may be expected to yield sawlogs in less than 100 years, and over much of the region the period must be longer. There is always the danger of fire and of parasites and diseases, while the taxation situation is uncertain. No one can forecast stumpage values 100 years in the future, and as a result capital generally cannot be attracted for the purpose. The fact is proved by the very large extent to which the poorer lands have reverted to the state through tax delinquency in the past, and by the rapidly increasing rate of reversion. In a practical sense, Michigan's wild lands are not now looked to as very significant in the future sawlog production of the country. It is true that the second growth furnishes, and in the future will furnish increasing quantities of pulp wood, posts, poles, and firewood, but few sawlogs. Such forest products are important, but stumpage values are very low even in the more accessible sections, and almost non-existent in most of the region. Such forest products do and will furnish wages to many workers, but they do not mean large returns to the owners of the land.

With growing appreciation of the futility of holding lands for increased values for farm and forest utilization, many owners become dubious about holding them at all. There is much complaint about high taxes, but the tax rates are high only because

the land has no utility in the ordinary sense. There is no market for farm or forest use, and hence assessed valuations of one to ten dollars per acre, and tax rates of ten to fifty cents actually are confiscatory in many cases. As a whole, capital values of land are being slowly reduced to the vanishing point through lack of actual or potential utility, and the proof lies in the fact of state ownership of more than 10% of all the wild lands in Michigan.

THE STATUS OF RECREATIONAL USE OF LAND IN MICHIGAN

In northern Michigan recreational land use already has developed on a considerable scale. The state now owns 1,600,000 acres, the bulk of which has accrued through tax delinquency (Fig. 4). State forests have been established where wild lands have been blocked up more or less solidly in several areas. The original idea behind the state forests was the desire to put this otherwise worthless land to productive use, and to demonstrate the desirability of forest use. In recent years several state game refuges have been established, in most cases in connection with the state forests, which have become public hunting grounds. Private hunting preserves ranging from a few 40-acre tracts to

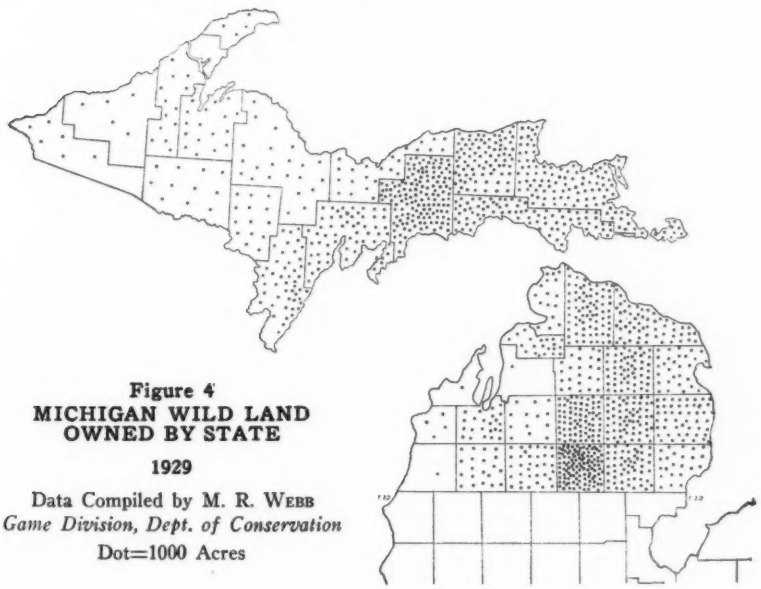

Figure 4
MICHIGAN WILD LAND OWNED BY STATE
1929
Data Compiled by M. R. WEBB
Game Division, Dept. of Conservation
Dot=1000 Acres

Figure 5
WILD LAND CLOSED TO PUBLIC
Mostly Private Hunting Preserves
Dot=1000 Acres
STATE OWNED WILD LAND
Closed as Game Refuges
Cross=1000 Acres
Compiled by M. R. WEBB
Game Division, Michigan Dept. of Conservation

50,000 acres or more, are becoming more and more common throughout this section. A recent survey showed that some 600,000 acres in the north are included in private preserves closed to the public (Fig. 5), and no doubt much greater area is held primarily for hunting purposes. The inception of the state game refuge development a few years ago was prompted in part by a desire to make better use of some of the state owned lands, but also to furnish hunting grounds for the public, since such considerable and choice areas were entering private ownership for the distinct purpose of giving exclusive hunting rights to the individual owners and clubs. Many large land owners in the north are paying taxes and holding their lands with the major idea that they soon will become marketable for private hunting grounds, rather than for farming or forest. Without the stimulation of this potential outlet it is probable that the extent of tax delinquency would be considerably greater than at present.

For the ordinary types of land utilization, therefore, northern Michigan to the extent of some ten to fifteen million acres is pretty much a blank. It is not potential agricultural land, and utility for sawlog production is so far in the future and so uncertain that

essentially nothing is being done toward the consummation of the foresters idea of a producing forest. Michigan is not alone in possessing large acreage of this character. The other Lake States, much of New England, and extensive parts of the Appalachians have similar problems. An enormous portion of the eastern part of the country has been reduced to a condition of little or no utility.

Without effective competition from the normal demands of land use, recreation becomes relatively of greater importance. Much of this northern country possesses characteristics of environment which attract certain types of recreational use. Great stretches are essentially wilderness with very scattered population. Inaccessibility is an advantage in certain cases and for some uses. The forest fires which have so heavily depleted the reproduction of commercial timber types, on the whole have probably improved the carrying capacity for some types of game. Swamps, with their acid peat soils, are important as winter cover and feed for deer. Rough surface, short growing season, long winters, and heavy snowfall do not detract from values. The factors which preclude the ordinary uses of land in many cases are just those which attract recreation, and in reducing values to a low level make extensive holding of land for recreation possible. A new set of geographic conditions comes into play which requires a new orientation in the consideration of use values.

The values involved in these northern hunting areas are based upon a set of conditions very different from those which underly other types of land use. The actual hunting is primarily for deer and partridge, with the emphasis on deer. Bears, rabbits and fur bearers are significant, but in a minor way as compared to these two. The quality of country in terms of stocking of deer and partridge in large part determines its value. There are great differences in stocking in different sections. A complex series of relationships remains to be worked out, but it seems probable, on the basis of heavy stocking which exists in some sections, that carrying capacities are many times those of the present stocking in much of the area. One factor which has been critically involved in the improvement of recent years is the control of fire. Michigan now has a highly efficient system of fire prevention and control. The underlying cause of this organization does not lie primarily in the necessity of protection of merchantable timber. The virgin hardwood forests which remain and the uncut swamps never have been subject to very serious fire hazard, and there has been no other merchant-

able timber worth saving. The forest associations which occupy the cut-over, burned-over areas in general do not have stumpage values. In the days of agricultural booming fire was looked upon as a boon to the settlers in helping the process of land clearing. The basic argument for fire protection has been to maintain the game cover, to give it a chance to develop, and to make the country more sightly for recreational purposes. This is an argument which everyone can understand and appreciate, and the results have been strikingly evident in recent years. The scars of fire are being healed rapidly, and the north country in general has a quite different appearance from that of ten years ago.

Fire control, together with game-law regulation and enforcement, undoubtedly has resulted in a very great increase in the number of deer, which in turn has increased recreational values. The importance of game is evidenced in the concern over the decline in numbers of partridges in the north, and the feeling that a very real resource was endangered. Many of the choicer, better stocked hunting grounds in the Lower Peninsula are now in the hands of clubs and individuals for the single purpose of game preserves. State lands in the vicinity of some of the larger hunting clubs are valued highly, and are in great demand. The establishment of a new state game refuge means a decided increase in values of surrounding lands, and once a refuge is established its expansion by purchase of adjoining lands is almost impossible because of increased prices. The experience of the past few years, while it involves, after all, but a small part of the wild land area, suggests what may be expected for much of it in the future. The facts indicate a rapidly growing demand for land in large volume for a type of use heretofore considered of little signficance. A new alignment of values and utilizations must be made on the basis of this new demand for wild land. An enormous area is available, but it is certain that a demand for lands of good quality for this use is growing at a rate much more rapid than for any other use, and there is every reason to believe that the demand will continue to grow.

In the expansion of agricultural, lumbering, and grazing use of land in the United States, there has been almost no direction or control by governmental agencies. The individual has been free to use his own judgment. In use of land for recreational purposes a somewhat different set of conditions exists. In Michigan, for example, the state is faced with the problem of administration

of considerable areas of land. As noted, the state now owns more than 10% of the wild land, and there is every indication that the area will continue to increase rapidly. In large part it was the problem of administration of this large area, together with the bankrupt condition of much adjoining land, which led to the organization and procedure of the Land Economic Survey. It was realized that before any effective policy of land classification and assignment to use could be made, the necessary data as to character of land must be available. This has led to the procedure of the Survey, which is essentially a geographic inventory. The interest and influence of state direction and control does not end with state ownership of land. In Michigan and most other states, the ownership of game birds and animals, as well as fur bearers, is declared to be vested in the state. Under this circumstance the state has proceeded to make all sorts of regulations as to open seasons, bag limits, trapping regulations, etc. The state also has been involved in stocking lakes and rivers with fish, and in introducing various birds and animals. The game farm, largely for the rearing of pheasants for release in the southern part of the state has been an important phase of the work of the Department of Conservation. Through many years a series of statutes has grown up which gives this body almost unlimited powers in the direction and control of all affairs related to wild life. Hence leadership rests with the state agencies, and an opportunity for the first time presents itself for directing the use of great areas of land.

CONTRIBUTIONS GEOGRAPHY CAN MAKE

It is difficult to overemphasize the importance of geographic studies in connection with the administration and direction of recreational land use. The maps of the northern counties produced by the Land Economic Survey show distributions of soils, cover, lay of the land, in a degree of detail unequaled elsewhere for such areas. In addition detailed maps of stream and lake conditions are made, and various economic distributions are worked out. These maps have been basic to the beginning of scientific administration, and their effectiveness is evidenced by the fact that both Wisconsin and Minnesota have followed with substantially the same form of survey for their wild land areas.

The geographic inventory, as produced by the Survey, is merely the first step in the necessary study of these areas. Such data must be analyzed, and the various relationships worked out before

this phase of the job is complete. Since the chief value of the land rests upon its present or potential game population and carrying capacity, various problems of biogeography present themselves, and work along these lines is getting under way. The major relationships which are important in the recreational use of these areas are those between the wild life populations and the conditions of environment, which gives a geographic flavor to nearly all the problems involved.

TITLES AND ABSTRACTS OF PAPERS
COLUMBUS, 1929

LAWRENCE MARTIN.

The Michigan-Wisconsin Boundary Case in the Supreme Court of the United States, 1923-26. (PresidentialAddress. To be published in full in a later issue.)

WALLACE W. ATWOOD (Read by title).

Our National Parks.

These Parks have long been spoken of as the "Playgrounds of America." They are among the most remarkable wonderlands of this continent and should they not become the centers of scientific studies and educational work during our summer field seasons?

DANIEL BERGSMARK (Introduced by Nevin M. Fenneman).

Agricultural Geography of Clermont County, Ohio.

W. O. BLANCHARD (Read by title).

Maladjustments to Environment in Spanish Agriculture.

With the general march of progress characteristic of western Europe, Spain and Portugal have failed to keep step. On a map of Europe showing cultural and material progress, they appear as outliers of the eastern countries, of Russia and the Balkans.

Agricultural backwardness is due in part to unfavorable climatic and topographic conditions, but more to the failure of the human factor to make the most of its opportunities. Conspicuous among such lack of adjustments are the (1) overemphasis of cereal crops with too little attention to the animal industries, (2) lack of fertilization, irrigation, intelligent crop rotation and of modern methods and mechanical aids in general, (3) poor division of the land with the result that vast areas are poorly tilled or unproductive, (4) inequitable distribution of the tax burden with agriculture carrying more than its share; (as an example of government efficiency note the following: the Cadastral Survey designed to furnish the government with data for the more equitable distribution of the tax burden began its work in 1903, and by 1924, twenty-one years later, it had covered only one-third of Spain), (5) general lack of respect for manual labor, (6) large proportion of illiteracy (almost one-half of those over six years of age are unable to read or write). This is of course in large measure the chief obstacle to the correction of many of the other troubles.

As an example of what may be done under unfavorable natural conditions the Spanish farmer has but to take note of the Dane on his sandy heaths, the Swiss on his rugged mountains or the Dutchman on his waterlogged marshes.

JAMES F. BOGARDUS (Introduced by Frank F. Williams).

Recent Production and Movement of Coal in Western Europe.

Recently Europe has been producing a little less than one-half of the world's supply of coal and the great majority of the world's supply of lignite. Coal production has increased slightly during the past five years but is still below the pre-War level. However, the production of lignite has increased rapidly and is much above the level for 1913. If the combined production of coal and lignite in the terms of coal be considered, the increase during the past five years has been 9.2% and the present production slightly exceeds that of 1913. This decrease in the production of coal and the very small increase in the production of coal and lignite marks a response to the slight advance in European consumption which has been retarded by the use of substitutes and by improvements in the technique of using coal.

Production in the more important areas has varied. The greatest decrease is to be found in the United Kingdom, while Germany, Poland, France and such smaller countries as Belgium and the Netherlands have increased the amount mined. Germany has also shown a tremendous increase in the production of lignite.

The international movement of coal is gradually changing. The exports of the United Kingdom, which is normally by far the greatest exporter, have gradually declined. Recently its chief markets such as France, Germany and Italy have declined due, in part, to effective competition from German and Polish coal. German exports have also declined while those of Poland have shown some increase.

The falling off in foreign trade seems to be due to the development of local fuel resources in many countries which have erected tariff barriers, to the increased use of substitutes, and to improvements in the use of coal.

These changes have led to a surplus productive capacity which in turn has led to unemployment, cut-throat competition for foreign markets and government subsidies. It will be necessary for Western Europe to reduce its productive capacity until it more nearly coincides with its consumptive capacity before stabilization can be achieved and some form of international control should be

set up to regulate foreign shipments. Movements in both of these directions are under consideration at present. It seems doubtful whether the demand for coal will increase rapidly in the near future and consequently there is little likelihood of the return of the prosperous conditions in the coal industry such as existed prior to the World War.

CHARLES F. BROOKS.

Gulf Stream Daily Thermograms Across the Straits of Florida.

During the past four years the Gulf Stream has been subjected to investigations of a new type: continuous records with sea-water thermographs have been made by vessels crossing it. Details of temperature, including alternating masses of warmer and cooler water, diurnal ranges of temperature, and rapid changes in distribution, have been written on the thermograms, to form an amazingly complex picture.

Thermographs are in operation on four lines across the Gulf Stream: (1) Key West and Habana, (2) New York and Porto Rico, (3) New York and Bermuda, and (4) Halifax and Bermuda and British Honduras; on the Ice Patrol Ships, Boston and Halifax to the Grand Banks; on the New York, Panama and San Francisco run; and the French training ship *Jacques Cartier* crosses the Gulf Stream on various lines on its trips between France and the southern U. S. Ports. The instruments are operated under the supervision of the U. S., Canadian, and French weather services.

An instrument on one of the Key West to Habana car ferries provides the temperature record for one round trip daily while the ship is in operation. The southbound trip gives a night profile and the northbound a daytime one. From night to day in sunny, quiet weather the sea temperature at the surface rises from 3 to 4 deg. F. and at a depth of 6 feet about 2 deg. In windy weather the diurnal range is reduced to 1 deg. or less.

The summer profile is characteristically warmer in the north than in the south, while the temperature of Key West harbor stands out several degrees above the Gulf Stream. A band of cool water is almost alway traversed within a mile of the Cuban shore, apparently where swell and current striking the steeply sloping bottom bring cool water to the surface. The winter profile is usually two or more degrees warmer in the south than in the north portion of the Straits. A sharp line, often a narrow streak of probably upwelling water several degrees cooler than on either

side, usually divides the warmer water from the cooler. This boundary shifts many miles with wind and other effects that bring at one time more water direct from the Caribbean and at another time more from the Gulf. Great variations sometimes occur in the course of a few hours.

Storms, chiefly through their stirring action, reduce the surface temperatures by one or more degrees. Strong cold winds have an even greater effect than hurricanes, for they chill the water considerably as well as mix the warm surface layer with the cooler substrata.

The daily mean temperatures have ranged from 77° F. (Feb. and Mar.) to 85° (Aug.) in the south, and from 73° (Mar.) to 86° (Aug.) in the north portions of the Straits. The extremes have been 62.5°, Nov. 24, 1928, and 87.5°, July 30, 1928. A Key West harbor temperature of 91.6° was recorded July 4, 1929.

This paper will be published in the *Monthly Weather Review.*

ROBERT G. BUZZARD (Introduced by Wallace W. Atwood).

The Red-Top Production of Southeastern Illinois.

A native prairie grass of southeastern Illinois, known in the seed-buying trade as "red-top," has brought agricultural prominence to this portion of the state. Not only does the region supply the domestic demand for the chief constituent grass for lawn and golf-course mixtures, but at least four foreign countries look annually to the region for grass-seed supply. The name is derived from the color of the head at the time when the seed is of the maturity for harvesting.

Being native, the grass thrives on the badly worn, poorly drained and acidic soil of this prairie frontier. The seed has become the ready-money crop of the area, and measures in a surprising degree the profit of the average farmer in the area. The hay has become the supply forage for the winter season. The attention to quality needed to obtain the highest price for both seed and hay has led to consideration in harvesting methods that equal the care given the cereal grains. The small size and the light weight of the seed has taxed the ingenuity of the thresher and the seed-cleaner, and localized inventions have made possible turning into trade seed in any grade the trade demands, together with a 100% utilization of the crop as harvested.

The farm crisis, general in the Middle West, has turned the interest of the federal relief to the red-top growers. The coöperative organization in the locality is expecting to rebuild prosperity

through federal aid. Governing conditions, due to the peculiar qualities of the crop, however, prevent the success of co-operation as now organized. Few crops demand such technical knowledge for successful handling. Most of the development is due to the scientific attitude of one man, the leading market-man of the area.

F. A. CARLSON (Introduced by Eugene Van Cleef).

Geographical Index Numbers.

The term, geographical index, is a mathematical expression of a geographical relationship. It is intended that the geographical index should represent the power or degree of man's utilization or adjustment to his environment. In computing the indices, it has been established that, a base index number, 100, should be indicative of a complete reciprocal relation between man's distribution, his activities and the environmental elements. An index number, for each one of the elements related to man at a given place and time, is determined and, then, the average is computed and recorded as a geographical index. For example, a given field is utilized for the cultivation of corn. A synthesis of said field and activity shows that first, the soil is unsuitable for corn; second, drainage conditions are unfavorable; and, third, the demand of market for corn is low. However, if this same field was utilized for the growing of grass and the grazing of cattle, other conditions being the same, the returns would be more satisfactory or it may be said that the geographic relation is more nearly complete and as a result the geographical index is higher than in the case when corn was grown. A geographical index number should not be confused with the index of mere productive power or capacity of a given area. An index of production shows what a given area can be used for most efficiently on the basis of its inherent quality while a geographical index tends to reveal not only what man can do, but also what he is doing, and what he should do to better his utilization of the environment or adjustment to his environment. If a geographical index number fulfills its intended purpose, it should prove a valuable symbol for maps in showing the intensity of man's relation to his environment. In a detailed field study of the Gadsden and Birmingham Districts of Alabama the results have been expressed in terms of the geographical indices. The comparative value of these industrial districts may be clearly determined through an analysis of the recorded indices. The geographical index may be used with reference to urban land or rural areas. The topographical maps of the United States may be

extended in their scope and purpose through the insertion of geographical indices. Thus, the topographical atlas of the United States, which is in preparation, may be recognized as a Geographical Atlas.

WILLIAM S. COOPER (Read by title).

Glacier Bay in 1929.

During the summer of 1929, all the low-level glaciers of Glacier Bay were visited except the Geikie. The Muir Glacier front, practically stationary from 1916 to 1921, with a retreat of two miles between 1921 and 1926 (W. O. Field), has changed but slightly since 1926. Carroll Glacier, non-tidal since 1921, has retreated a short distance. Rendu Glacier, active in 1916, no longer presents a true ice cliff. Grand Pacific Glacier shows signs of impending advance. Its center has thickened enormously since 1916, and the barely tidal front has changed from a low vertical cliff not more than 150 feet high to a steep bluff-like slope three times that height. Margerie Glacier has not changed notably since the retreat of the Grand Pacific left it as a separate ice front, but a slight net advance has occurred since 1916. The ice front of the Johns Hopkins Glacier is now eight miles back of the mouth of its inlet. Its recent history is unknown, as the inlet has been so choked with ice as to render navigation impossible. The Lamplugh and Reid Glaciers have undergone no important changes during their history as separate ice fronts. Hugh Miller Glacier, no longer tidal in 1926, has shrunken slightly. In general, all the glaciers except the Muir have fulfilled their periods of rapid retreat as tidal glaciers. The Muir, still in deep water, will continue for a time to recede with considerable rapidity.

GEORGE B. CRESSEY (Introduced by O. E. Baker).

The Geographic Regions of China.

The major divisions of China is into two sections, the north and the south, with a boundary midway between the Yangtze Kiang and the Hwang Ho. These two regions present striking contrasts in topography, climate, land utilization and human development.

For more detailed analysis China may be divided in to fifteen natural regions as follows, reading from north to south:

1. The Mountains of Eastern Manchuria
2. The Manchurian Plain
3. The Khingan Mountains
4. The Central Asiatic Steppes and Deserts

5. The Mountains of Shantung, Liaotung and Jehol
6. The North China Plain
7. The Loess Highlands
8. The Central Mountain Belt
9. The Yangtze Plain
10. The Red Basin of Szechwan
11. The Tibetan Borderland
12. The South Yangtze Hills
13. The Southeastern Coast
14. The Hills of Liangkwang
15. The Southwestern Tableland

W. M. DAVIS (Read by Title).

The Bay of San Francisco, California.
Physiographic Contrasts, East and West.
The Varieties of Cuestas.

SAMUEL N. DICKEN (Introduced by D. H. Davis).

Kentucky Karst Landscapes. (By permission of the Director of the Kentucky Geological Survey.)

In western Kentucky the broad exposures of the Upper Mississippian limestones, especially the St. Louis and the Ste. Genevieve, are responsible for the development of karst surfaces, associated with extensive underground solution and erosion. This karst region is located on the margin of the structural depression known as the Western Coal Basin and the gentle dip of the rocks tends to develop the varying karst landscapes as narrow bands, paralleling the strike. The individual character of each landscape is associated with changes in the solubility of the rock, both horizontally and vertically, the proximity of the allogene streams, the inherited landscape pattern and other local factors.

The karst, dependent ultimately in the presence of soluble rock, is nevertheless limited in surface expression by the relative intensity of denudation. If at a particular point the karst processes are comparatively active, rock and soil are removed rapidly and the resulting depression tends to develop convex slopes. If denudation becomes more important, the bottom of the depression becomes filled, and the lower slopes, at least, are concave. The ideal sequence of forms is: *ponor, doline, ouvala,* and *basin,* but such relations are not observable in the field.

In the vicinity of Mammoth Cave a pre-karst landscape appears before the sandstone capping layer has been entirely removed.

This landscape presents the usual ridge and valley pattern except that in the small tributaries and on the interfluves, small *ponors* or sink-holes have appeared and captured the surface drainage. Obviously the character of this pre-karst landscape varies with the quality of the parent landscape.

In the *doline*-karst solution has been active for some time and the dominant forms have steep slopes, convex in their upper portions, at least, and are regularly round or oval in ground plan. The *dolines* rarely exceed 100 feet in diameter or 60 feet in depth, in contrast to the forms caused by the falling of cave roofs, which are usually much larger and are moreover very irregular in form.

The *basin*-karst is the result of the retardation of the karst processes and the partial filling of the depressions by denudation. The *basins* are large, irregular in ground plan and exhibit characteristic concave slopes, some of which are so gentle as to be scarcely perceptible.

The last karst landscape marks the beginning of the return of surface drainage as the insoluble bed is reached. The basins become filled with sediment, small stream courses become established on their slopes and eventually surface drainage is restored.

Other varieties of landscape exist in the Kentucky karst, but a discussion of them must await a more elaborate presentation.

STANLEY D. DODGE (Introduced by Preston E. James).

The Distribution of population in Connecticut.

The distribution of population (67.8% urban) in Connecticut is related to the distribution of the principal routes of commerce. Along these routes, connecting Boston and New York, centers of population are strung like beads on a string, principally along Long Island Sound from New York to New Haven, north from Bridgeport in the Naugatuck Valley, in the Connecticut Lowland, and in the connection between the Naugatuck Valley and the Connecticut Lowland, stretching from Waterbury to New Britain. These centers of population have developed from nuclear groups of people attached originally to particular loci on the surface of the earth. The determination of these loci within the areas occupied by the majority of the people of the state shows in detail the distribution of population. Outside the areas of concentration, the rural people are scattered, but they show, nevertheless, distinct local and smaller agglomerations (towns and villages), each of which has its own characteristic locus.

O. D. VON ENGELN (Read by title).

Geography of Los Angeles, California.

Los Angeles today is the metropolis of the Pacific coast of North America. The predominance results from the combination and concentration at Los Angeles of a remarkable number of potent geographical factors. The attractive all-year-round resort conditions, climate, mountains and beaches, together with the development of the region for the citrus fruit industry, early attracted much personally accumulated capital and its proprietors (many of whom were Middle Western farmers) to the site. Then the motion picture industry with its background of lavish expenditure became fixed at Los Angeles by the dependability of the sunlight and the marked variety of attractive "on location" possibilities in the region. Concurrently a flood of oil was discovered and developed in and immediately around the city. In the near future avocado production south of Los Angeles promises to assume an importance second only to that of the citrus fruit industry. It was found possible at Los Angeles to open a safe harbor of ample proportions on a coast where such sites are few, the while the Panama Canal was proving itself a needed facility and west coast North American and South American shipping was having a remarkable growth. The easiest railway routes from the east of the United States have Los Angeles as their Pacific coast terminus. Of equal or greater significance is the fact that newly established transcontinental air-liners ply between New York and Los Angeles.

In its human aspects Los Angeles is the expression of exuberant American enterprise supported by an abundance of capital, finding its outlet at a semi-tropical site and supplied with additional wealth in huge quantities as the bonanza resources and environmental items listed above became effective.

Buildings, roads and institutions that would be impracticable in a city even slightly frost-bound in winter are found here. Los Angeles is not at all affected by natural limitations of site comparable to those of New York.

In 1929 and for some years previously real estate activity has been slack due to overbuilding, but a revival in construction is anticipated. It has been recognized that the essential function of a city is commerce, and Los Angeles' future growth will be based chiefly on the enlargement of such activities. The limiting factor to further great expansion of Los Angeles is the water supply needed, but the promise of ample quantities of this essential com-

modity in the Boulder Dam development of the Colorado River makes it improbable that there will be any failure of growth due to such need. Meanwhile Los Angeles is progressively depopulating, by wholesale purchase of private property, the whole of the Owens valley in accomplishing its purpose of absorbing the total water resources of that area.

EDITH M. FITTON (Introduced by Charles F. Brooks).
The Climates of Alaska.

Alaska has no climatological homogeneity, for regions adjacent on the map are found to have widely different climatic characteristics.

The contrast between a marine climate along the Pacific Coast and a continental climate over the rest of Alaska is due to three factors chiefly—duration of sunshine, variation in relief and exposure, and position with regard to surrounding seas and ice. A region in the latitudes of Alaska undergoes large and rapid daily changes in the number of hours of possible sunshine.

The Pacific Coast mountains and the Brooks Range, because of their great heights, act as very effective climatic barriers, isolating the interior plateau from the influences of the surrounding seas. This accounts for the extremes of temperature and the low precipitation found in the interior.

The surrounding oceans have a profound effect on Alaska's climates, causing moderate temperatures and heavy precipitation where their influence is paramount, as on the Pacific Coast. Even when frozen and therefore tending to take on land characteristics, the seas still moderate temperatures somewhat for the unfrozen water beneath the ice gives off some heat to the surface. Thus the absolute minimum temperature on the Arctic Coast is $-56°$ while in the interior, cut off from ocean winds to north and south, a minimum as low as $-70°$ has been recorded. In the matter of precipitation also, the frozen seas lose the main part of their effectiveness as water bodies, for winds crossing the ice are chilled by it and furthermore can find little moisture available, and for these reasons carry a very small amount of vapor to the land.

A study of temperature, amount and distribution of rainfall, and physiography in Alaska indicates several distinct climatic provinces into which the country may naturally be divided: Pacific Coast and Islands Province (Marine); Pacific Coast and Islands Province (Rain-Shadow); Bering Sea Coast and Islands

Province (Semi-Ice, Marine); Arctic Coast Province (Ice-Marine); and Interior Province (Cold Continental). The names of the provinces are intended to denote their geographic location, from which something of their climatic characteristics may be inferred. Further indication of the outstanding features of the climate of each province is made by the brief phrase in parentheses following the names.

In Alaska, as elsewhere, climate is really the basic element of the environment. But in most of Alaska the climate is so extreme in temperature, precipitation, or storminess that it demands a more perfect adjustment on the part of man, animals, and vegetation than a more temperate climate requires. Weather there is not something that may be taken for granted—it is a very active, compelling consideration in all phases of every day living.

ROBERT BURNETT HALL (Introduced by K. C. McMurry).

Some Rural Settlement Forms in Japan.

A study of rural settlement forms may be carried out in three degrees of detail: (1) regional patterns of population distribution; (2) morphology of the rural agglomerations; and (3) morphology of the occupance units. Studies on this plan were made in four regions of Japan: the Yamato Basin, Satsuma, the Echigo Plain, and the Tokachi Plain. These four areas illustrate settlement forms which are widespread in Japan but which do not exhaust all of the types. Rarely do the types occur unmixed. Transition zones, overlaps and detached islands in many places complicate the pattern, yet there is a distinct regional distribution which can be demonstrated by quantitative analysis.

(I) The Yamato type presents rectangular arrangement and is an exotic culture form introduced from China. It is found in the Yamato Basin and adjacent plains of the Kinki district. (II) The Satsuma type represents a relict form of feudal days and is found in Satsuma, Osumi and part of Hyuga. (III) In the Echigo type the settlement forms are closely adjusted to the dry-point sites of compound delta plains. The pattern is further shaped under the influence of land ownership. It is found on several of the delta plains bordering the Sea of Japan. (IV) The Tokachi type is a result of recent settlement under the influence of the American range and township system. It is found on all areas of low relief in Hokkaido.

RICHARD HARTSHORNE.

The St. Paul-Minneapolis Double Rail Center.

Minneapolis-St. Paul is the type of urban center, peculiar to North America, in which the study of the railway structure may be the fundamental phase of urban geography. The most unusual feature of this center is the development of "twin cities" which are not two "half cities," separated politically but not geographically, but two separate centers growing into a single urban center but retaining widely separated and complete nuclei, neither of which is dominant. This situation, originating in the embyronic pre-railroad period, has been perpetuated by the railroad structure which developed in relation to certain features of the natural landscape. Most important of these is the wide, deep, glacial valley of the Minnesota-Mississippi River. Others are the course of the rivers in the district, the post-glacial gorge of the Mississippi Rver below St. Anthony Falls and the low-banked but wide river above them, smaller tributary valleys, and certain morainic hills and lakes.

Two points of critical importance, ten miles apart, have developed as separate, though never independent, centers. The point in the north bend of the Minnesota-Mississippi Valley where a river terrace is modified by a tributary stream, was originally significant in locating the major port, St. Paul, which marked the ordinary limit of lower river navigation, and was the largest and most promising town of the early state. But this was also the easiest point of connection between the railways following the main valley to the southeast, south, and southwest, and those utilizing the small tributary valleys to climb on to the upland, heading northwest, north, northeast, and east. The other point was marked where Nicollet Island offered the easiest crossing of the upper Mississippi, in close juxtaposition to the flour mills at the Falls. This crossing was important when rail construction began, as the site of the only railroad bridge across the Mississippi and of the second largest among the several small towns of the early state, Minneapolis (including St. Anthony). These two points were too far apart for the development, in the early days, of a single rail center. But they were close enough to make it feasible for any line to one center to extend its operations to the other. Later, the construction of a common switching district where the band of lines connecting the two centers narrows because of the relief, aided the physical union of the peripheries of the two cities, and made logical

their treatment in all rail relations with outside regions as a unit, though double, center.

GEO. D. HUBBARD.

Oberlin's Peculiar Spring Weather.

Spring weather in Oberlin is proverbially nasty. Cold and rain or slushy snow annoy students and guests. Lake Erie has been charged with the excesses and does bear part of the guilt. Studies of the relations of cloudiness, precipitation and coldness to "lows" and "highs," and to topography seem to show that the gently rising slope from Lake Erie up to this vicinity together with the wind direction, state of ice in the lake, and the season will explain most of the trouble. This paper is a preliminary report.

HENRY F. JAMES (Introduced by Frank E. Williams).

The Kishacoquillas Valley.

This paper describes the Kishacoquillas as physically typical of the limestone valleys in what is known as the Ridge and Valley Region of Pennsylvania. It sets forth the development of the peoples who have occupied the valley, the Scotch-Irish and the Amish Mennonites, showing briefly the extent to which it has influenced their economic development, and, in turn, the extent to which the inhabitants have set their stamp upon the valley.

The study considers particularly the Amish people, their persevering and successful struggle with the Scotch-Irish for control, their futile but unceasing fight against progress as represented by this machine age, and their development of the Kishacoquillas Valley as the home of a distinctive and prosperous agricultural community.

The Kishacoquillas Valley has been a geographic laboratory, well equipped with the factors of inaccessibility remoteness, necessity, and natural wealth, in which an unusual and interesting human experiment has been performed by a people determined to maintain the traditions of their forefathers. It appears that remoteness and inaccessibility are being rapidly removed as determining factors, with the result that these simple and picturesque people will all too soon lose their identity. They will be fused into the great American melting pot as schisms reduce the numbers and weaken the resistance of those who desire to pass down to succeeding generations their idea of life based on simplicity, frugality, and perseverance. The valley appears destined to harbor eventually nothing more than a typically prosperous agricultural community.

PRESTON E. JAMES.

Vicksburg: A Study in Urban Morphology.

Vicksburg is in many respects characteristic of the towns of the lower Mississippi Valley which have not yet been touched by the wave of industrial development now sweeping the South. With a population of somewhat over 20,000 which it has maintained with minor variations for three decades, Vicksburg may be described as static, but not necessarily permanently static. The town may be important for two reasons; (1) as a fortress town, occupying a strongpoint site on the valley bluff overlooking the Mississippi, a reason for growth which becomes of dominant importance only when the Mississippi Valley is being contested by two powers; and (2) the town may grow as a commercial transfer point between river traffic, and the products originating in the territory which lies to the north, east, and south, in the west-central portion of the State of Mississippi. This latter reason for growth depends on the prosperity of a varied portion of the cotton belt, and, more particularly, on the use of the river for transportation. Railroad development favors Jackson, which since the early years of this century has forged rapidly ahead of its river-town rivals.

The structure of Vicksburg exhibits many of the elements of typical city growth. Established in 1824, at a time when a regular rectangular street pattern was the vogue, Vicksburg's arrangement is of this type. The rectangular pattern was applied to the site, also, with a singular lack of imagination, since it is orented almost north and south regardless of the trend of the valley bluff and of the mature ridges and ravines back of the valley bluff which run from northeast to southwest. The street widths, too, betray the fact that the town has developed along different lines than those proposed for it by its founders. The residential suburbs, added since the original survey of 1824, have been controlled by no city plan, and are unhampered by restrictions of any kind. Real estate development plans have been good, bad, or indifferent according to the character and training of the realtors. In most cases each subdivision has a pattern of its own, only poorly integrated to the city structure as a whole. Within the more closely built sections there is remarkably little vacant land. Negro residence districts occupy the ravines, and close by on a horizontal map but overlooking them from the ridge tops, are the residential districts of the white people. On the outskirts of the town this arrangement is not so rigidly adhered to, since one superior white residence

area is in a lowland section, and many of the ridge tops are occupied exclusively or in part by negroes.

MARK JEFFERSON.

Lake Huron Exceptionally High.

This summer the Great Lakes are higher than in many years, Huron and Michigan five feet higher than in February, 1926. Along the St. Clair River valuable structures have been submerged and the shores north of Port Huron and north of Chicago have suffered loss of bathing beaches and houses and roads brought within reach of destructive storms. Summer high water is usual on Lake Huron, a foot higher than winter levels, no doubt because summer has four inches more rain than winter in this basin. This seasonal oscillation is very systematic and regular, yet last winter the water level did not drop. The rain was in excess instead of defect as usually at that date, an excess that continued into July. 1923, 1924, and 1925 were years of deficient rain. In the beginning of 1926 Lake Huron had gone down to 577.3 feet and the Chicago Drainage Canal was very unpopular. 1926, 1927, and 1928 had rain in excess and the water rose to 582.3 feet in July, 1929. Now the rain is in defect again and the lake has fallen a foot below its midsummer level, but for three years the Drainage Canal has been unable to keep the lake down to desired levels.

MARK JEFFERSON.

The Six-Six World Map, giving larger, better continents.

(Published in this issue).

W. L. G. JOERG.

The Significance of Bellingshausen's Antarctic Voyage of 1819-1821.

The circumstance that for over seventy years after its original publication in Russian in 1831 no translation existed of the official account of this expedition is mainly responsible for the fact that this important voyage is not as well known in the Western World as it deserves. The much abridged German translation by Gravelius (1902) and, based on it, the accounts by Dr. H. R. Mill in the Geographical Journal for 1903 and in his history of Anarctic exploration (The Siege of the South Pole, 1905) remain practically the only records available to the student not familiar with Russian. Even if familiar with Russian an American student has been handicapped hitherto by the fact that no copy of the original

Russian report seems to exist in the United States—only a copy of the atlas in the Library of Congress.

On the basis of the publications mentioned and especially of a photostatic copy of the original Russian text and atlas recently acquired by the library of the American Geographical Society a brief account of the expedition will be given and an evaluation made of its significance. The relation to Cook's fundamental Antarctic voyages of 1772-1773 and 1773-1775 will be brought out. Bellingshausen in the selection of his routes consciously supplemented those voyages. Cook definitely disproved the theory, then still prevalent, of a Southern Continent reaching into the temperate latitudes, and showed that if land existed around the South Pole it must lie within much narrower confines. Bellingshausen restricted the possible area still more, and did it so effectively that his farthest advances remain unsurpassed to this day in certain sectors and some of the Antarctic islands he discovered still await further exploration. The paper will be illustrated by maps showing Cook's and Bellingshausen's routes and facsimiles of Bellingshausen's detailed surveys.

CLARENCE E. KOEPPE (Introduced by Charles F. Brooks).

Some Phases of Climate in the Canadian Spring Wheat Belt.

The western, northern and eastern limits of the region are marked roughly by the 60-degree isotherm for the three summer months; the southern limit by the international boundary. The land is not all prairie and plain; it is broken by hilly and plateau areas and by numerous scarps. The northern part is largely under a forest cover of aspen, poplar, birch, spruce and pine. Though the climate is strictly continental at all times, except as the chinook may modify it, there are many local differences, paricularly with respect to precipitation. In southeastern Alberta, conditions approach semi-aridity; on all the higher situations precipitation is heavier, and the amounts increase fairly regularly with progress eastward. Temperature conditions likewise vary locally. Winters are colder in central and eastern Alberta than in Manitoba; summers are hottest in southern Saskatchewan. Extremes, in both winter and summer, tend to be less near the Rocky Mountains and toward the southeastern margin of the region.

In January, mean temperatures are everywhere under 20° F.; and in much of the area they are below 0° F. With few exceptions, all parts of the province have reported temperatures of –45° F. or lower; and Prince Albert reported –70° F.

one February. A feature of the prairie winter is the wide range in mean, as well as in extreme, temperatures, from one year to another; the difference in means for one station has been as great as 37° F. The summers are relatively short but exceedingly warm for the latitude, 110° F. (the highest in Canada) having been reported from Saskatchewan. Fluctuations in the July means from year to year do not exceed 11° F. The average frost-free period averages from two and one-half to three months; the period from the average date of seeding to the average date of the first frost may be as much as four and one-half months.

The average annual precipitation is small, rarely above 20 inches, and frequently below 15 inches. The variations from year to year are relatively great—some years, three times the normal; some years, less than half the normal. The seasonal distribution of precipitation is particularly favorable for wheat culture: from 50% to more than 70% of the annual total comes in the four months from May to August. Snowfall is notably light, the general average being less than 40 inches; and it is much more erratic than rainfall. The region is characterized by abundant sunshine, especially in summer, and by freedom from continuously high winds, although severe blizzards do occur occasionally in winter.

HENRY M. LEPPARD (Introduced by Charles C. Colby).
Settlement of the Peace River Country.

The vanguard of settlement reached the Peace River Country relatively late. In 1906 the white population consisted of a few traders and missionaries. The Census of Canada of 1911 records the presence of 900 persons. By 1916 the population had risen to 9000. Ten years later the region had nearly 20,000 inhabitants.

The penetration of settlement is intimately correlated with the climate, relief, natural vegetation, and soils of the area as well as with its location. The provision of adequate trasportation facilities remains one of the pressing problems of the Peace River Country.

K. C. MCMURRY.
The Use of Land for Recreation.
(Published in this issue.)

JOHN L. PAGE (Introduced by Charles F. Brooks).
Temperature and Temperature Provinces of Mexico.

Mexico is not so hot a country as its latitude might suggest, much of the country being at sufficiently high altitude to have its

temperature much reduced. The Central Plateau has a summer temperature slightly lower than that of Portland, Maine. The country offers great diversity in the degree and course of temperature through the year. Altitude, exposure, and water bodies appear to be greater controls of degree of temperature than does latitude, while seasonal distribution of cloudiness and rainfall exert a marked influence on the course of temperature through the year. May to September, inclusive, are each represented as the month of maximum temperature in some part of the country.

Mexico falls, naturally, into eight temperature types or provinces, each differing from the others in degree or course of temperature through the year or both.

This paper will be published, with last year's discussion of rainfall, as a supplement to the Monthly Weather Review.

A. E. PARKINS.

A Study in Urban Geography—Nashville.

This paper is, in part, a report of "progress" of the study of Nashville as a type, one of a series of studies in comparative geography; but it is concerned largely with land utilization in the commercial or business area, and in particular in the retail section.

The problems set up for study are: (1) to locate the most important retail district; (2) to measure in some objective way the intensity of land utilization in the various sub-sections of the retail district; (3) to work out the direction of expansion of this center; (4) to discover what physical conditions man was adjusting himself to in locating the retail district where it is and in selecting the line or lines of expansion; (5) to discover why some sections of the retail district are more actively used than others.

Intensity of use was measured by: (1) the height of the buildings—number of stories on the site; (2) the percentage of buildings used actively and for storage; (3) the quality of the buildings; (4) the quality of occupancy; (5) the type of occupancy, that is, the particular kind of business.

It was decided that these five elements or items could best be shown geographically by profiling selected streets in the business section. The paper is illustrated by a series of profiles, crossing the business section.

The study shows that the most active business section or subsection is on streets that carry most pedestrians, a phenomenon that was to be expected; and that the most used streets are the level streets. In the growth of the retail business section of the city the

frontier of the most important retail section advanced over essentially level ground. The river, slopes, and public buildings have served as barriers to the migration of the retail business frontier.

ROBERT S. PLATT.

An Urban Field Study: Marquette, Michigan.

The city of Marquette is a phenomenon of the regional pattern of terrene occupancy to be interpreted as to its external relations and its internal structure. The fact of its existence is linked with the regional functions of certain local establishments for which Marquette has certain advantages of location.

Marquette Bay is nearer than any other harbor to the Marquette Iron Range and has been the shipping point for most of the ore from this district since the opening of the first iron mine in the Lake Superior region.

Now that the two ore carrying railways have grown into systems extending beyond the mining district, Marquette has both a terminal and a central position with reference to their lines and has been a logical choice for the head offices and shops of each.

The railways focusing at Marquette serve various forest areas, and in the recent period of hardwood logging by railway, the city has become a center for the manufacture of wood products.

The districts served by the Marquette railways are consumers as well as producers, and for the cluster of communities in and near the Marquette Range, a few commodities are manufactured at Marquette and many more are distributed from that point. The main part of this commercial district forms a county of which Marquette is the county seat.

Although situated on one of the shore boundaries of Michigan, Marquette is in a large reëntrant of the coast and is in a central position with reference to the various separate groups of communities in the Upper Peninsula. Accordingly Marquette has functional relations with the region beyond the commercial district, as a focus for certain interests, particularly of sorts that have to do with movements of people or intangibles rather than of commodities.

In its primary aspect, the city is a point where regional interests focus, but since the local establishments require physical space in which to operate, the city has areal extent and a definite arrangement fitting into the natural background of its site.

In general the city pattern reflects development from the ore shipping point as a focus with reference to which the urban nucleus

crystallized and urban interests spread in accordance with their individual requirements and the exigencies of the site, this process being modified by the extension of some of the facilities from the original focal point to other points, making possible the development of secondary foci.

HOMER C. SAMPSON (Introduced by E. N. Transeau).
Vegetation Types and Soil Types in Marion County, Ohio.

Correlations between vegetation types and soil types are frequently reported. These correlations are most obvious when the change in soil type is dependent upon sand or upon conditions of drainage and aeration. Other factors of plant distribution may frequently be more important than soil types (as they have been mapped and published by the Bureau of Soils of the U. S. Department of Agriculture) in determining the distribution of vegetation types. The discrepancies between soil types as mapped and vegetation types fall into two classes: (1) when the same vegetation type occurs upon many different soil types, and (2) when different vegetation types occur upon the same soil type.

The distribution of the Beech-Maple Forest Type may be taken as an illustration of the first class. The main belt of Beech-Maple in North America extends across the States of Indiana, Ohio, Northern Pennsylvania, Michigan, Southeastern Ontario, and New York. The climatic conditions of this area appear particularly favorable to Beech-Maple. In Northeastern Ohio near the center of distribution of this belt, Beech-Maple occurs on at least a dozen different soil types and upon half as many different soil series within the the area occupied by a few counties. If the area is extended to include the entire geographic range of this vegetation type, the number of different soil types upon which it is found is increased several times. The distribution of other vegetation types illustrates the same phenomenon.

The second class in which several different vegetation types occur on the same soil type is well illustrated in Marion County, Ohio. The principal upland soil type in Marion County is Miami silty clay loam, and it is distributed generally throughout the county. The principal vegetation types on this soil type within the county limits are (1) Oak-Hickory in the central and north central part of the county, (2) Beech-Maple on the east, south, and west, and (3) Oak-Maple as a transition zone lying between the areas occupied by the other two plant associations. The Crosby silty clay loam occupies a relatively small part of the total area of the

county, but upon it within the county limits are Beech-Maple, Oak-Maple, Oak-Hickory, and the Red Oak-Linden phase of the swamp forest formation. The Clyde silty clay loam was formerly occupied by a number of vegetation types including the Bullrush-Phragmites community of marshes; the Cordgrass, Panicum, and Andropogon associations of our Central Western Prairie; and the Willow-Cottonwood, Elm-Soft Maple-Black Ash, Bur Oak-Elm, and Red Oak-Linden Communities of the swamp forest formation.

All of the vegetation types listed for Clyde silty clay loam also occurred upon both Newton clay loam and Newton silty clay loam within the county limits. Apparently all of these vegetation types and also Beech-Maple occurred on Brookston silty clay loam.

The vegetation types listed above are not local in extent. On the contrary, they are the natural vegetation types that formerly covered the country from Ohio to Kansas.

R. H. SARGENT.

Aerial Mapping in Southeastern Alaska.

During the summers of 1926 and 1929 expeditions from the Navy Department have been making aerial photographs of much of southeastern Alaska for the Geological Survey and the Forest Service. These photographs are made from an elevation of approximately 11,000 feet. They have proved of invaluable service to the Geological Survey, where they are used to supplement the general work of mapping by the usual ground methods. The amount of data and the ease with which they can be acquired from the photographs is remarkable. To the Forest Service the photographs have proved of much value in studying the timber and water-power problems of the region.

They serve as a permanent record to which access may be had at any time and thus serve as a valuable source of information.

In addition to the mapping photographs many remarkable oblique photographs were taken which are also of great value, not only to the Geological Survey and the Forest Service, but to many other Federal bureaus, and it is believed may record much data of scientific value.

The paper deals with a description of the methods employed, the actual flights of the planes, the technique of mapping, and a description of other valuable data obtained.

R. H. SARGENT.

A Study of the Results of Ice Flow as Shown in Oblique and Vertical Photographs Taken of Glaciers in Southeastern Alaska.

A part of the results of the Alaskan Aerial Survey Detachment of 1926 and 1929 to southeastern Alaska was the photographing of the fronts of practically all the large glaciers of southeastern Alaska both by oblique photographs taken over the side of the plane and vertical photographs taken from an elevation of 11,000 feet.

These photographs yield a wealth of interesting and valuable scientific data regarding the phenomena of moving glaciers and the results of such movements upon the ice mass.

It is not the purpose of this paper to discuss the dynamics of these phenomena, but rather to illustrate the facts.

HELEN M. STRONG.

Geography of a Foreign Investment.

The geography of a foreign investment, or the geography of commerce, covers a broader and more important field than the familiar commercial geography whose emphasis is upon the movement of commodities. The foreign investor needs to know the regional geography of the area where he is operating, and the significant relation of the physical background to his enterprise. Thus regional studies are of large practical importance and provide fundamental material for the geography of commerce. Commerce is complex, far reaching, and many sided.

A geographic analysis should be a fundamental part of every foreign investment. The contribution thus made to the undertaking may mean its success, and failure to make the study may result in failure for the enterprise. In these days of keen competition only cognizance of every significant element in an enterprise will insure its success. It is the practical regional interpretation which is the crux of the geography of commerce. No one form of geographic analysis will apply to every foreign enterprise. Each enterprise possesses its own inherent characteristics, which in turn imply their own complement of geographic relations. Only a thoroughly trained professional geographer can handle adequately the complex and technical problem involved in consideration of a foreign investment. The geographer faces a fascinating opportunity to develop a significant demand for his contribution by prac-

tically studying foreign enterprises, and analyzing their geographic relations.

If geography can produce many practical studies of this kind, it will demonstrate to the man directing foreign investment enterprises, the value and significance of the geographic analysis to the success of his work, for he already feels the need for the geographer's contribution.

C. WARREN THORNTHWAITE (Introduced by D. H. Davis).
A Quantitative Classification of Climate.

The familiar Koeppen classification of climate marks a tremendous advance in the precise analysis of one important landscape feature. Noteworthy in this classification is the attempt to evaluate precipitation on the basis of the temperature at which it occurs, not only in the steppe and desert climates but in the dry season climates as well. The classification lacks precision, however, in several respects. (1) Since the dry climates are defined in terms of mean annual temperature and total annual rainfall seasonal variations in precipitation fail to receive due recognition. Thus the steppe area having warm rainfall is exaggerated in area while that having cold season rainfall is contracted. (2) The deserts are displaced slightly poleward. (3) The formula defining steppe makes the area too wide on the cold margin and too narrow on the hot margin. (4) According to definition summer-dry humid climates must have at least three times as much precipitation during the coldest month as during the warmest, while the winter-dry humid climates require at least ten times as much precipitation during the warmest month as during the coldest. Annual range of temperature is not considered but should be because the greater the temperature range the greater will be the contrast in effectivity of the summer and winter precipitation.

In the present classification these difficulties have been overcome since the effectivity of the precipitation of each month has been evaluated on the basis of the mean monthly temperature at which it falls. The total of the monthly precipitation ratios is the precipitation effectivity index. Thus precipitation is expressed in terms of a common temperature denominator. In deriving the formula for expressing the effectivity of mean monthly precipitation in terms of the mean monthly temperature at which it falls all available observations and calculations of evaporation were associated

with their corresponding temperature and precipitation values and analyzed statistically. The equation follows:

$$R=11.5\left\{\frac{P}{T-10}\right\}^{\frac{10}{9}}$$

R=Monthly preciptation effectivity ratio
T=Mean monthly temperature
P=Mean monthly precipitation
Precipitation effectivity index=sum of twelve monthly ratios.

The precipitation effectivity index has been calculated for all stations in the United States where temperature and precipitation data are available for a period of ten years or more. Isopleths of precipitation effectivity have been drawn and correlated with distribution of vegetation. The following five humidity provinces have been defined:

Desert—Effectivity index less than 16
Steppe—Effectivity index 16 to 31
Grassland—Effectivity index 32 to 63
Forest—Effectivity index 64 to 127
Rain forest—Effectivity index 128 and above.

These form the primary subdivisions in the classification. A secondary temperature classification has been adapted, with slight modifications, from Koeppen. The tertiary classification, based on seasonal distribution of precipitation, depends upon the relation of the precipitation effectivity of the three warmest and three coldest months to the effectivity index.

E. N. Transeau.

Precipitation Types of the Prairie and Forested Regions of the Central States.

The precipitation types of the Short Grass Plains, the Tall Grass Prairie and the adjoining Forest Regions show marked contrasts in monthly and annual variability.

On the High Plains the precipitation varies from 15 to 30 inches on the average, most of it falling during the growing season in the form of local showers. Consequently there are considerable monthly and annual variations which result in frequent droughts and inadequate soil moisture for the growth of large plants.

In the Forested Regions the precipitation varies from 30 to 45 inches, is more regularly distributed throughout the year and the annual variation is not large. Consequently there are neither frequent nor prolonged droughts.

In contrast to both these regions the Tall Grass Prairie region, with an average precipitation between 30 and 40 inches shows extremes both in monthly and annual variations. This results in great irregularity of available soil water, and occasional prolonged periods of drouth. This is believed to be one of the important characteristics differentiating the prairie climate from that of the plains and the adjoining forested regions. This has also been an important factor in the development and maintenance of the unique prairie soil type.

The paper presents a graphic method of showing these variations.

E. N. TRANSEAU.

Progress in the Survey of the Vegetation Types of the North Central States.

For the general map of this region it has been found possible to differentiate the following types of vegetation: Prairie, Oak-Hickory Forest, Oak-Maple Forest, Beech-Maple Forest, Scrub Oak Barrens, Northern Swamp Forest, Southern Swamp Forest, Pitch-Shortleaf Pine Forest, Beech-Maple-Hemlock-White Pine Forest, Northern Pine Forest, Spruce-Fir Forest, Post Oak Savanna, Oak-Hickory-Pine Forest, Mixed Slope Forest, and the Oak-Chestnut Forest.

On the county and state maps it is possible to analyze some of these types further. This is particularly true of the several phases of the Swamp Forest and the geographic and local phases of the Oak-Hickory Forest.

The field work has brought out very clearly the distinctness of the prairie and the adjoining forest; the local and the geographic variations of the several types as to composition and species dominance; the complete absence of any supporting facts for Clements' concept of "The Association" as "an organism;" the abundance of data showing that what is a developmental stage in one part of a state, may be the so-called "climax" in other parts; and that any system of nomenclature that makes distinctions between communities on the basis of developmental stages as "Associations," "Associes," etc., may very well be fitted to local areas, but results in hopeless confusion in describing the vegetation of larger areas. Vegetation in nature can not be fitted into these Procrustean beds of *a priori* classifications.

STEPHEN S. VISHER.

Evidences as to the Frequency, Intensity and Causes of Weather Changes in Tropical Regions.

As part of the study of the effects of tropical cyclones, an effort was made to see how wide a zone is affected appreciably. Minor cyclones, usually ignored because of their lack of destructiveness, have also received especial attention. In order to obtain concrete evidence on these points, the daily weather maps of Australia (20 years), India (5 years), the Far East (7 years) and the middle North Pacific (4 years) were studied in detail, as well as daily weather maps or records for Fiji (4 years) and for Mauritius, Porto Rico, southern Brazil, and various other stations for two years or less.

Study of these daily weather reports reveal that considerable change in rainfall and slight changes in other weather elements occur almost daily in these areas. The weather maps also throw light on the causes of these changes. Tropical cyclones are seen to be much more frequent than has been supposed, even recently. For example instead of there being an average of about 34 a year, as announced in a well known official monograph on tropical cyclones published in 1913, the fuller records now available record nearly 100 a year which produce winds of gale or hurricane force, and the daily weather reports discuss more than 100 additional, of lesser intensity. Instead of affecting zones only a few score miles wide, as was stated when the emphasis was on destructiveness, the weather maps reveal that the weather is affected appreciably over a belt averaging more than four times as wide as that having strong winds, extending even beyond the area with closed isobars and cyclonic winds. The weaker tropical cyclones, nearly always ignored in discussions of tropical cyclones, are several times as numerous as destructive hurricanes, and often affect the weather over even wider areas. Likewise they often move slower and persist longer than well-developed storms, inducing convectional thunderstorms. They also affect the strength of the more persistent winds, the monsoons or trades, strengthening them on one side and weakening them on the other.

Other causes of tropical weather changes disclosed by the daily weather maps studied are midlatitude lows and highs, which, during the winter season, often extend into the margin of the tropics and affect appreciably the weather over considerable areas.

In brief, tropical cyclones, mostly remote or weak, cause frequent slight changes of the weather during most of the year in representative parts of the tropics. During the winter when tropical cyclones are relatively rare, midlatitude lows and highs frequently affect tropical weather. These influences together cause the weather to change so frequently that it is seldom quite the same three days in succession. Changes of rainfall are especially marked.

R. H. WHITBECK.

Observations in Porto Rico and Jamaica.

LANGDON WHITE (Introduced by Wallace W. Atwood).

The Iron and Steel Industry of Youngstown, Ohio.

Youngstown is in the throes of a struggle to hold an eminent place in the nation's metallurgical industry and to retain a reasonable margin of profit. Since it is the oldest iron and steel center in Ohio and until recently ranked next in importance to Pittsburgh (even now it stands third), one wonders why its future is regarded with anxiety. Geographical analysis shows that Youngstown's location for iron and steel manufacture is generally favorable, though it is beset with some limitations.

Youngstown lies (1) near coal and limestone deposits, (2) less than 70 miles from Lake Erie ore ports, and (3) in the "Ruhr of America"—that rectangle 100 x 180 miles, which is the world's greatest iron and steel region. Within the "Ruhr" are three of America's ten largest cities, nine urban centers with populations of 50,000 or more, and one-twentieth of the country's inhabitants —all indicative of enormous consumptive demand. Yet competition here is intense, since there are eight other metallurgical districts—Canton, Cleveland, Detroit, Pittsburgh, Shenango Valley, Steubenville, Toledo, and Wheeling. Of these rivals, Pittsburgh and Cleveland are most formidable. In competing with them for certain markets, Youngstown is at a distinct disadvantage, because of higher transportation costs, both in assembling raw materials and in disposing of manufactured products. Pittsburgh, located at the confluence of the Allegheny and Monongahela Rivers and at the head of the Ohio, reaps the rewards of cheap barge rates on coal inbound and on some steel outbound. Cleveland, on Lake Erie and the Cuyahoga River, benefits from water carriage on ore and limestone inbound and on some steel outbound. But *landlocked* Youngstown is hedged in by restrictive rail freight rates. It is therefore striving to get direct rail connections with the Ohio

River in order to utilize barges part way on coal and some steel. Its petition to extend the line of the Pittsburgh, Lisbon & Western Railway was recently denied by the Interstate Commerce Commission. But both the Pennsylvania and the Pittsburgh & Lake Erie have agreed to provide facilities for transferring coal from barges to railway cars and steel from cars to barges at points on the Ohio some forty miles from Youngstown. This will reduce substantially the rates now prevailing.

The inertia of invested capital will help maintain production. And this, with its early start, favorable location with respect to markets, coking coal, limestone, and ore ports, and finally with the benefit to be derived soon from barge-rail carriage on coal and some steel, make it appear that the advantages slightly outweigh the disadvantages. Moreover, the companies operating here are units of huge corporations that have spread their network far and wide, a circumstance which should enable their executives to maintain the Youngstown plants efficiently. Accordingly, this district should continue to hold a prominent place in the metallurgical sun.

DERWENT WHITTLESEY.

Chorography of the Boston (Mass.) Locality: A Report of Reconnaissance.

The reconnaissance required about 80 hours in the field and was confined to the area continuously built up with occupance forms urban in function.

Three major chorologic zones have been recognized. (I) *The Hub,* comprising functional forms characteristic of the centers of large cities. Locus—near the center of the Boston Basin, a faulted depression in a region of crystalline rock, floored with sediments and half is submerged beneath the sea. Site—a morainic headland at the landward end of submergence, surrounded by water barriers except on the neck, where a railroad forms a barrier boundary. Occupance—wharves and rail termini along the seafront, wholesaling on reclaimed tidal flats, retail and office business on gentle slopes and adjacent reclaimed land, close-built residences—slums and mansions—on hills along the landward stream barrier. (II) *The Inner Girdle,* crescentic about the Hub, on glacial outwash and till overlying argillite, or conglomerate of relatively gentle relief. Extending to barriers of tidal flat or fresh marsh, of rugged hills along fault planes, of corporate ownership and associated occupance. Prolonged where railroads bridge barriers or induce manufacturing. Within a 10-cent fare and about 40

minutes of the Hub. Occupance comprises wharves and railroad yards, factories, retail centers, public and semi-public institutions, and residences—frame "tenements," cottages, and relict mansions, and brick city-type houses and apartment buildings. Further study would differentiate the Inner Girdle into chorologic types. (III) *The Outer Girdle.* (A) High-grade residential sections on high or hilly sites or along attractive water, connected with the Hub by rapid stream transport. Well-built houses on large lots; subordinate business districts. (B) Medium quality residential sections (mainly houses on 50-foot lots) with subordinate retail sections. Like the Inner Girdle, on gentle relief and within the 10-cent fare, but more remote from the Hub in time. (C) Manufactural villages on water power sites, recently distended with stereotyped cottages on narrow lots, occupied by people who work in the Hub.

The reconnaissance suggests tentative hypotheses as to occupance in the conurbation as a whole. (1) Barriers of tidal flat and fresh marsh define zones within the conurbation; (2) bridgehead sites carry occupance across stream barriers; (3) power sites counteract the barrier quality of streams; (4) the crystalline margins of the Basin define the conurbation wherever it reaches so far; (5) fault and contact planes within the Basin mark variance in occupance; (6) low, level ground is associated with transport, manufacturing, business, low-grade residence, playgrounds, reservations; high points with reservoirs, monuments, schools and hospitals; rolling ground, not very rocky, with residences, grading up in quality with elevation; rocky ground with parks and reservations; (7) political boundaries strongly reinforce and sharpen transition zones between different functional forms.

FRANK L. WILLIAMS.

Location of the Iron and Steel Industries of the Schuylkill Valley.

Close upon the heels of the pioneer with his rifle and ax came the forge man and the furnace man. In nearly every district where there was wood for charcoal, water for power, and ore, the iron worker was one of the first settlers and his industry made agriculture easier because he helped remove the timber.

The Schuylkill Valley was one of the first areas to develop its iron and hence is of special interest in this industry. Early iron ore deposits had much to do with the location of bloomeries, forges and even furnaces. The presence of ore was important as it was

not necessary to go far to get both water and wood (for charcoal). Small ore pockets were found widely scattered, but the best deposits were between Norristown and Reading; hence the greatest number of bloomeries and forges were located on both sides of the river between the sites of these two cities.

The iron and steel plants of the Valley have changed in location due to depletion of raw materials, changes in fuel, demand for greater power, consolidation and necessity for better transportation.